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DISPLAY SEGMENT FOR THE C/P ARRAY SONAR SYSTEM.(U)
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TECHNICAL NOTE

DISPLAY SEGMENT FOR THE C/P ARRAY SONAR SYSTEM (U)

Submitted to
U. S. Naval Undersea Warfare Center
San Diego, California 92152

ATTENTION: Code D551

20 February 1968

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1. INTRODUCTION

(U) This technical note summarizes the present status of the Display Segment of the C/P Array Sonar System. The equipment which comprises the Display Segment is described in Section 2. Section 3 discusses the operational organization and the manner in which the displays will present sonar data to the operators. The controls used to operate the system are also briefly described in Section 3.

(U) It should be noted that the intent of this technical note is to summarize information contained in the various documents on the Display Segment. These documents are listed in Section 4.

2. EQUIPMENT SUMMARY

(C) There are two basic units in the Display Segment. These consist of the Multi-Mode Sonar Console (MMSC), and the Passive Data Memory Unit (PDMU). It is planned that the Experimental Ship System Display Segment will consist of two MMSC's and one PDMU. Tentative plans for the Prototype System called for four MMSC's and one PDMU. Figure 2-1 shows the configurations of the two segments. Note that the displays interface with the data processor only.

(C) The MMSC's and PDMU are being constructed by Hughes Aircraft Company. The specifications of these units and the proposed design are described in References 1, 2 and 3. Delivery of the first units is scheduled for April, 1969.

(U) The description of the console and the memory unit in Reference 3 is not accurate. Several changes have been made as a result of design review meetings between NUWC, Code D606 personnel and Hughes Aircraft Company. These changes are summarized in various monthly progress reports from Hughes, (Reference 5). The brief summaries of the MMSC and PDMU that follow reflect these changes.

2.1 MULTI-MODE SONAR CONSOLE

(U) The MMSC is a very flexible, general purpose display console. It has the capability of operating in any of several modes, each of which gives the operator a nearly optimum set of data formats and computer entry controls for the particular task associated with that mode.

(U) The MMSC internal modules are shown in Figure 2-2. The unit contains interface and control logic circuitry, a

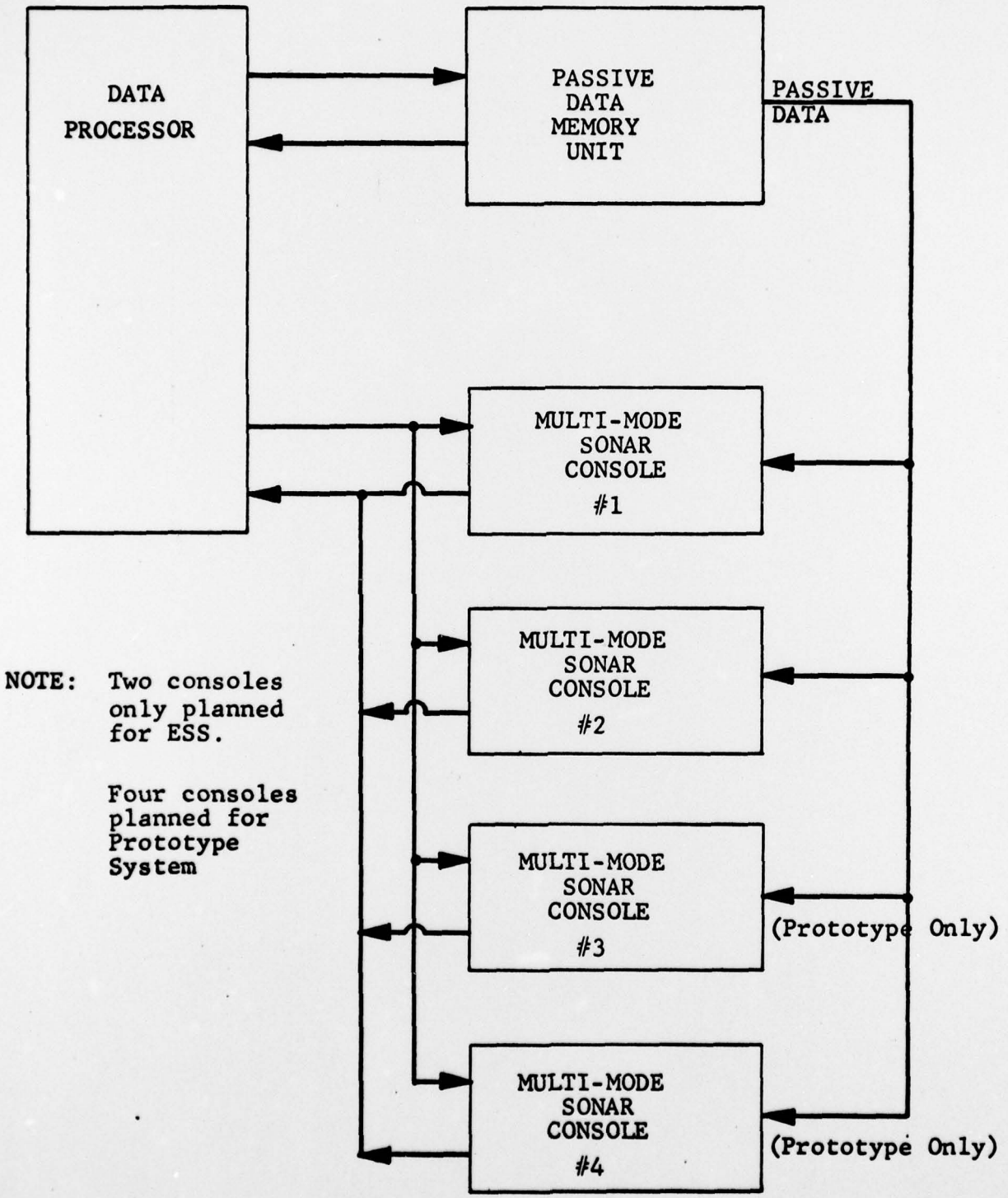

FIG. 2-1. DISPLAY SEGMENT

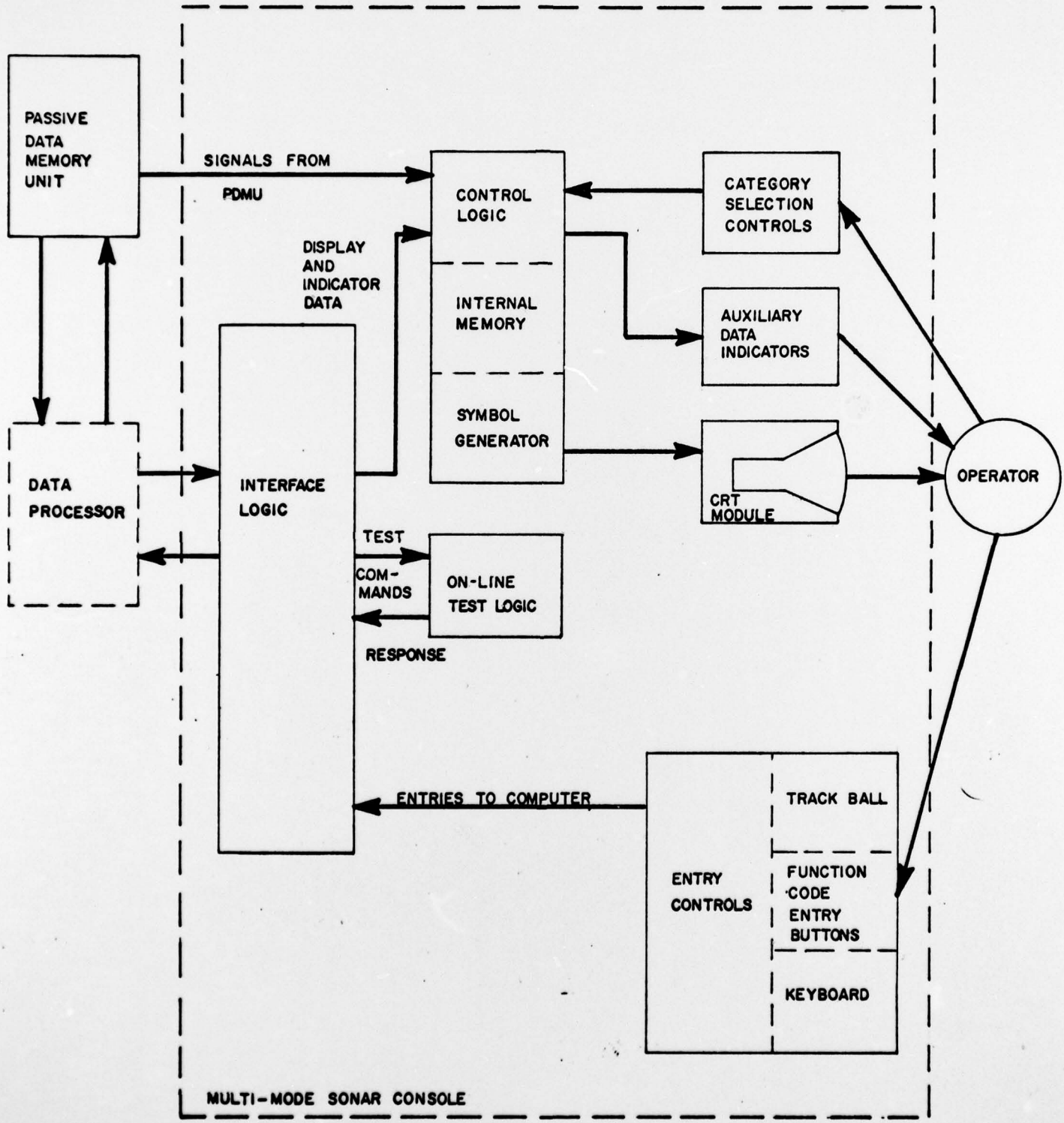

FIG. 2-2. DISPLAY SEGMENT, MULTI-MODE SONAR CONSOLE BLOCK DIAGRAM

DWG NO 106

8192 word (36 bits/word) internal core memory, symbol generator, operator entry controls, category selection controls, auxiliary data indicators and a 16-inch diameter cathode ray display tube.

(U) Data from the computer are stored in the internal memory as computer designated symbols. These are category-selected for display by the operator and presented in a selected format on the CRT. Data are cycled from the memory at a rate sufficiently high to provide a flicker-free presentation.

(U) As currently configured, the MMSC has considerable internal control over the way in which data are presented. A portion (256 words) of the memory is reserved for storage of program instructions. The MMSC responds to these instructions in the same manner as a stored program G. P. computer operates. For instance, the console memory has the capacity to store data from several ping cycles. The timing and format of the presentation of these multi-ping data will be controlled by the stored program.

(U) Controls are provided to allow the operator to enter data into the computer. In general, these controls are mode dependent. Operation of a control causes a function code to be entered. The computer's interpretation of the code depends upon the particular mode in which the console is operating.

(U) Passive data are displayed in a raster-scan, time-bearing format. When the console is in the passive mode, raster timing and video intensity signals are received from the PDMU. The raster generation circuitry is contained in the console.

(U) Circuits within the console allow both on-line and off-line testing of the unit. The on-line tests are initiated and controlled by the computer. Location of a fault in any of the easily replaceable modules in the console can be done with the on-line testing. Off-line testing is conducted by maintenance personnel using an off-line test panel in the console.

(U) The symbol generator is able to generate up to 512 different symbols. These include lines of various lengths, alphanumerics, processed data symbols and other symbol types. See References 1 and 2 for a more detailed discussion of the console's symbol capability. The symbols can be displayed at any of eight levels of brightness.

2.2 PASSIVE DATA MEMORY UNIT

(U) The PDMU receives and stores passive data from the data processor. The unit contains a 8192 word core memory, control and interface circuitry and raster timing circuits. Data from the PDMU are available for display at the request of the console operators when the consoles are in the passive mode. These data are presented in a raster-scan time-bearing format. Timing of the raster is controlled by the PDMU. The unit recycles the data to the console at a rate (44 frames per second) which is sufficient for a flicker-free presentation. Nominally, the raster contains 680 scan lines and up to 144 data samples can be displayed on each line.

3. OPERATIONAL ORGANIZATION OF THE DISPLAY SEGMENT

3.1 OPERATING MODES

(U) Each console is capable of performing a given display task by setting the console to the operating mode related to the task. This section describes some of the operating modes which have been considered for the display segment.

3.1.1 Active Detection and Tracking Mode

(C) In this mode, the results of the active data processing will be presented to the operator. The basic format used in this mode will be a Range-Bearing (B-Scan) presentation showing the events in the single-ping ordered list developed in the data processor. Thresholded events from several pings can be stored in the consoles internal memory and displayed simultaneously thus giving the operator multi-ping detection capability. Events will be indicated in the format by symbols placed at the proper range and bearing. Amplitude and Doppler will be indicated by symbol shape and brightness. Other data, such as pulse type, surface duct detection, bottom bounce detection, or both can also be conveyed by the symbol type. Other symbols representing such items as automatically detected tracks, established tracks, classifications, passive detections and alerts, etc., will also be displayed along with the single ping events on the basic format.

(U) Ship referenced or true-bearing coordinate formats will both be available. Expansion and off-centering capability will also be provided.

3.1.2 Classification and Close Tracking Mode

(C) A classification and close tracking mode has been considered. In this mode, all data in a limited area around a suspected target would be displayed in an A-Scan format to give an operator highlight and aspect information. Additional development will be required on the signal processing and data processing segments before this mode can be provided.

3.1.3 Passive Detection Mode

(C) In this mode, the console will view the contents of the PDMU. Up to 50 minutes of passive history can be displayed in the basic passive format. Reference 9 contains a more detailed description of the passive mode operation.

3.1.4 Situation Summary Mode

(U) In this mode, the sonar operator will be able to view a concise summary of the underwater situation. Active and passive tracks, including current classifications being carried in the computer, will be displayed along with tactical data such as own-force disposition, weapon status, etc. It has been assumed that a mode similar to this will be needed by a sonar supervisor in an integrated sonar fire-control system.

3.1.5 System Control Mode

(U) This mode is used for controlling the operation of the sonar system. Data which will be displayed to the operator include:

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(a) System start up and shut down check lists
(b) Performance prediction data
(c) System status data

(U) In this mode, the console controls will allow the operator to select the various parameters related to operation of the system. These selections will be entered into the computer which will then initiate the necessary actions in the system control circuitry. Feedback to the operator will be provided in the form of system status displays which indicate that the desired system configuration has been achieved. Reference 14 contains additional information related to the operation of the displays in the system control mode.

3.1.6 Other Modes

(U) Additional modes of operation have been briefly considered as likely candidates for implementation. These include a training mode to allow operator training on the system and a performance-monitoring fault-isolation mode which allows trouble shooting of the entire system from the display console.

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4. DISPLAY REFERENCES

(U) The following documents contain information related to the Display Segment. References 1 through 7, and 11, are mainly concerned with the display equipment design. The remainder of the references contain functional requirements and information on the operation of the Display Segment.

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DISPLAY DOCUMENTS

1. NEL Specification No. 3180-66-2, February, 1966, "Multi-Mode Sonar Console and Passive Data Memory Unit," UNCLASSIFIED.

2. Revisions to above, issued October, 1967, UNCLASSIFIED.

3. Hughes Aircraft Company, FP-66-11-192, (B-1589), 2 August 1966, "A Proposal for a Multi-Mode Sonar Console and Passive Data Memory Unit." UNCLASSIFIED.

4. Hughes Aircraft Company, FR-66-11-8, Contract No. N123 (953)53350A, 7 January 1966, "An Investigation of the Requirements for a Multi-Mode Sonar Console." (U), ~~CONFIDENTIAL~~. (U)

5. Hughes Aircraft Company, Contract No. N00123-67-C-0833, "Monthly Progress Reports," August, 1967 through January, 1968, UNCLASSIFIED.

6. Hughes Aircraft Company, Contract No. N00123-67-C-0833, September, 1967, "Passive Display Memory Unit, Memory Type Study Report," UNCLASSIFIED.

7. Hughes Aircraft Company, Contract No. N00123-67-C-0833, "Multi-Mode Sonar Console Design Reviews,1 through 8," UNCLASSIFIED.

8. TRG Division, Control Data Corp., Document No. B-2087F, November, 1967, "Functional Performance Specification for ESS Display Function," (U), ~~CONFIDENTIAL~~. (U)

9. TRACOR Tech Note, SD-67-011-C, 18 May 1967, "Display Requirements for the Passive Subsystem, C/P Array Sonar Project," (U), ~~CONFIDENTIAL~~. (U)

10. Anti-Submarine Warfare Systems Project Office, Dept. of Navy, Naval Ship Systems Command, S22-17XR1, "Technical Development Plan for Conformal/Planar Array Sonar System SS-048 (U), 1 February 1967, ~~CONFIDENTIAL~~. (U)

11. USNEL, San Diego, California, 2110-30001, "ESS Baseline Description," (U), 23 June 1967, ~~CONFIDENTIAL~~. (U)

12. The following memorandums contain general information related to the design and use of the MMSC in the C/PA System:

A. Memo from H. Larsen to J. Gilbreath, 23 October 1967, Subject: "Mechanical Layout of the MMSC".

B. Memo from H. Larsen to J. Gilbreath, 19 October 1967, Subject: "MMSC Design Review."

C. Memo from H. Larsen to J. Hammond, Code D660, 2 January 1968, Subject: "Suggested Passive Formats for Simulation."

13. NEL, Code 3180, J. A. Roese, "Task Report on C/P Array Sonar Systems Display Requirements," (U), 1 June 1966, ~~CONFIDENTIAL~~ (2U)

14. TRG Division, Control Data Corp., Document No. B-2087G, "Functional Performance Specification for ESS System Control Function," (U), November 1967, ~~CONFIDENTIAL~~. (2U)